IS 11547-2 (1985): Electronic Weighing-in-Motion Systems, Part 2: Requirements [LITD 8: Electronic Measuring Instruments, Systems and Accessories]

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( Reaffirmed 2000 )

*Indian Standard*

# SPECIFICATION FOR ELECTRONIC WEIGHING-IN-MOTION SYSTEMS

## PART 2 REQUIREMENTS



**1. Scope** — This standard ( Part 2 ) covers requirements of electronic-in-motion weighing systems.

**2. Performance Requirements**

**2.1** *Errors Applicable to Static Tests*

**2.1.1** *General* — In general, the performance requirements specified in IS : 9281 ( Part 3 )-1981 'Specification for electronic weighing systems : Part 3 Requirements', are applicable to weighing-in-motion instruments when tested statically. Also, if load cells are used, they shall comply with the requirements of IS : 9281 ( Part 3 )-1981 when tested individually.

**2.1.2** *Off-centre load tests*

a) *Axle weigher* — Off-centre load tests shall be carried out with a test load equal to the maximum axle capacity placed transversely on the load receptor and at longitudinal position on the receptor.

b) *Bogie Weigher* — Off-centre load tests shall be carried out with a test load equal to the maximum bogie capacity placed transversely on the load receptor and over any part of the load receptor covering a length equal to the bogie axle spacing.

**2.2** *Errors Applicable to Dynamic Tests* — Where the total mass of a train is obtained by the summation of individual masses of wagons, bogies or axles, or individual wagon masses in any train are measured, the following dynamic errors are applicable.

**2.2.1** *Maximum permissible dynamic errors* — After the instrument has been adjusted to zero at no load, the maximum permissible dynamic errors, at any speed within the specified range, shall not be greater than the following:

a) *Totel train mass* — ±0·2 percent of the total train mass.

b) *Wagon mass* — ±1·0 percent of the wagon mass.

**2.2.2** *Dynamic repeatability errors* — The difference between any two indications obtained with respect to the same load measured under the same conditions shall not be greater than the absolute value of the maximum permissible dynamic errors.

**2.3** *In Service Errors* — The maximum permissible errors applicable in service for static tests are twice those specified in **2.1** and for dynamic tests are the same as specified in **2.2**.

**2.4** *Rules for the Determination of Errors*

**2.4.1** *Errors* — The static errors are the difference between the indicated mass and the equivalent load in standard masses.

The dynamic errors are the difference between the mass of the wagons when weighed statically, uncoupled and in a single weighing on a verified weighbridge, and the mass of the same wagons when weighed dynamically in the train.

**2.4.2** *Wagon mass* — The dynamic wagon mass errors are applicable fo the gross mass or tare mass of the wagons.

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**2.4.3** *Total train mass* — The dynamic total train mass errors are applicable to the total tare or gross mass of the train obtained from the summation of the individual wagon masses irrespective of the number, type or capacity of the wagons.

**2.4.4** *Net mass* — If net mass is obtained by subtraction of a tare mass from the gross mass, no additional permissible errors shall apply to the calculation.

**2.4.5** *Speed* —The dynamic errors are applicable at all speeds between the maximum and minimum specified for the installation.

**2.4.6** *Number of dynamic tests* — At least 5 test runs shall be carried out at the normal operating speed of the installation. If the normal operating speed is not at one limit of the speed range then the tests shall be carried out at the limit nearest the normal operating speed. At least 3 test runs shall be carried out at a speed at the other end of the speed range from the normal operating speed.

**2.4.7** *Service period* — Static tests are repeated every two years and the dynamic tests every four years.

**2.4.8** *Modifications* — The static test shall be repeated if any modification or service work effecting the accuracy and system performance is carried out on the static weighing system. For example, a load cell is replaced.

The dynamic test shall be repeated if any modifications are made to that part of the system which affects the dynamic performance, for example, the alignment of the track is varied or additional points are installed.

## 3. Construction Requirements

### 3.1 *Suitability*

**3.1.1** *Suitability for purpose* — An instrument shall be designed to be suitable for the purpose for which it is intended to be used, and shall be constructed to be suitable for service under normal conditions of use.

**3.1.2** *Suitability for verification* — An instrument shall be designed to enable the performance requirements of these rules to be applied.

### 3.2 *Operational Safeguards*

**3.2.1** *Fraudulent use* — Instruments shall have builtin safeguards to prevent fraudulent use.

**3.2.2** *Breakdown or accidental adjustment* — Instruments shall be constructed so that the effect of breakdown or accidental incorrect adjustment is selfevident.

**3.2.2.1** *Multi-segment indicators* — When the mass is displayed by means of multi-segment indicators, provision shall be made of manual or automatic testing of all digits.

**3.2.3** *Operational controls* — Controls of instruments shall be designed in such a manner that they cannot come to rest in positions other than those intended, unless during manipulation of the controls indication or printing is made impossible.

**3.2.4** *Speed controls* — Provision shall be made to prohibit weighing if the vehicle speed exceeds the maximum speed for which an instrument was verified.

**3.2.5** *Roll-back controls* — An instrument may operate with the vehicle moving in either direction but once weighing has commenced in one direction, weighing is prohibited in the reverse direction until the weighing has been completed.

**3.2.6** *Weighed vehicles* — An instrument shall weigh all wagons once only and shall not weigh vehicles in the train for which it was not verified, for example, locomotives.

**3.2.7** It is desirable that the system should indicate/print if the supply voltage and frequency go beyond the specified limits.

**3.3** *Indication and Printing Requirements*

**3.3.1** *Clarity of indication* — Indications or printings shall be clear and unambiguous and printings shall be indelible.

On digital indicators means shall be provided for ensuring that the indication at changeover point is stable.

**3.3.2** *Arrangement of digits* — Indications or printings shall permit reading by simple juxtaposition of the digits.

The digits of a numerical indicator shall be aligned in the direction of reading.

The decimal marker on numbers less than unity shall be preceded by a zero digit.

**3.3.3** *Denomination of indications* — Indications or printings shall include the units of measurement or their symbols, as listed in IS : 10005-1980 'International system of units (SI) and guide to use it'.

**3.3.4** *Height of digits*

a) *Displays* — The height of digits on digital shall be not less than $3 \times L$ millimetres (where $L$ is the minimum reading distance in metres) but not less than 8 mm.

b) *Tickets* — The digits printed on a ticket to indicate the mass shall be not less than 2·5 mm high. Words or symbols designating mass shall be not less than 2 mm high. Where the symbols are printed by the instrument in a limited character set symbols for units of measurement may be expressed in capitals.

**3.3.5** *Scale intervals* — The value of the scale interval shall be in the form 1, 2 or 5 times $10^n$ kilograms or tonnes, where $n$ is a positive or negative whole number or zero.

**3.3.6** In order that the digital representation of the masses weighed by the system is not interrupted due to power failure during weighment, it is recommended that an uniterrupted stand power supply source may be provided.

**3.3.7** *Suppression of digital indication* — When the indication appears only after a special operation, controlled by the operator or automatically by the instrument, the indication shall be suppressed while the instrument is oscillating.

Above maximum capacity a digital indicator shall blank out or display non-numerical characters. The indicated maximum capacity may exceed the maximum capacity marked on the instrument by up to 10 scale intervals.

Below zero a digital indicator shall blank out, display non-numerical characters or indicate mass preceded by a minus sign.

**3.3.8** *Printing requirements* — A permanent record of the individual wagon masses and the total train mass shall be provided. The following minimum information shall be provided:

a) An indication that the totalizer has been cleared and that zero has been set prior to a new measurement ( *see* **3.4.2** ).

b) Individual wagon masses,

c) Identification of each mass either by consecutive number or vehicle number,

d) Identification of non-weighed masses due to an error ( including overspeed ), and

e) Total mass.

If net mass is provided, the gross, tare and net individual wagon masses shall be recorded together with a specific identification number marked on the wagon.

**3.4** *Zero-Setting Devices* — A zero-setting device shall comply with the following rules.

**3.4.1** *Range* — The range shall not be greater than 4 percent of the maximum capacity of the instrument, and it shall be possible to adjust zero to the middle of the range.

An automatic zero correction device shall not function outside the zero-setting range.

**3.4.2** *Accuracy of zero-setting devices* —It shall be possible to set zero to within 0·25 *e*.

**3.4.3** *Instruments with digital indication* — An instrument with digital indication or printing shall be provided with an additional zero-indicating device if it is:

a) Not fitted with an analogue mass indicator, or

b) fitted with an analogue mass indicator on which the scale interval is greater than the digital scale interval, or

c) not fitted with an automatic zero-correction device with a self-checking feature designed to provide a fail safe indication when zero is not acquired to within ±0·25 scale interval of zero.

This device shall indicate whenever the instrument is balanced to within ±0·25 scale interval of zero, and if it is an analogue device its scale interval shall not exceed the digital scale interval of the instrument, it shall be located adjacent to the mass indicator.

If the zero indicator is a light, it shall be illuminated only when indicating zero to within ±0·25 *e*.

**3.4.4** *Control for zero-setting device* — The control for the zero-setting device shall be separate from the taring device control, and shall be arranged so that the user can observe the zero indicator.

**3.4.5** *Automatic device* — If the instrument is designed to operate automatically that is without an operator, zero shall be automatically set prior to a weighing. An indication that zero has been set correctly shall be shown on a permanent record of the weighing.

**3.5** *Taring*

**3.5.1** *General* — Where taring is provided, it shall operate in conjunction with a vehicle identification code if the tare has been stored from a previous weighing of the empty vehicle.

**3.5.2** *Accuracy of setting* — The digital taring device shall permit subtraction of the tare value to ±0·5 *e*. The scale intervals (*e*) of the taring device shall be the same as the scale interval of the indicating or printing device.

**3.5.3** *Indication* — The indications of gross, tare and net masses shall be clearly identified on the permanent record with the words GROSS, TARE, NET or G.T.N.

**3.6** *Auxiliary Devices*

**3.6.1** *General* — The instrument shall have an indicator available for verification purposes.

However, auxiliary indicating devices such as ticket printers and digital displays may be located either at or remote from the load receptor and any additional indicator requirements specified in this standard.

**3.6.2** *Vehicle identification* — A vehicle identification system may be fitted to the instrument provided that the identification number is recorded and corresponds to the recorded mass of the same vehicle.

**3.7** *Verification Marks* — Provision shall be made for a verification mark in the form of a stamping plug or a destructible adhesive label, which shall be located so that the mark:

a) Can be easily affixed without affecting the metrological properties of the instrument, or

b) Is visible without moving the instrument when it is in use.

If a stamping plug is used, it shall consist of a lead plug securely set below the surface of an under cut hole, and so secured that it cannot be removed from the instrument without defacing the verification mark. The lead plug shall have a circular face of not less than 12 mm diameter or a rectangular face of dimensions not less than 8 × 25 mm and be accessible for stamping by means of a 50 mm long stamping tool.

If a destructible adhesive lable is used a space of not less than 25 mm diameter shall be provided for affixing the label. The space shall be flat, flush with the surrounding surface or raised, but not recessed into the surface.

**3.8** *Markings*

**3.8.1** Instruments shall be clearly and premanently marked on one or more permanently attached name plates with the following information:

| | |
|---|---|
| Accuracy class | III (for example) |
| Manufacturer's name or trade-mark | ..... |
| Serial number | ..... |
| Maximum capacity | *Max*..... |
| Minimum capacity | *Min*..... |
| Verification scale interval | $e =$ |
| Scale interval | $d =$ |
| | or $e = d$..... |
| Maximum additive tare ( if applicable ) | $T = +$..... |
| Maximum subtractive tare | $T = -$ |
| Maximum axle or bodie capacity | ..... |
| Speed range | ..... |

**3.8.2** *Style of markings* — All markings and notices shall be clear and permanent.

Capital letter and numbers shall be not less than 2 mm, high. Numbers and symbols of units shall be presented in accordance with the weights and measures regulations and IS : 10005-1980 'International system of units (SI) and guide to its use'.

## EXPLANATORY NOTE

While preparing this standard, assistance has been derived from Manual No. 8 'Design manual for weighing-in-motion system for trade use', issued by National Standards Commission of Australia.



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